Wicking Beds


This section explains how a wicking bed works, the advantages and disadvantages of wicking beds and looks at some wicking bed designs and how to build them.

what is a wicking bed?

A wicking bed is a garden bed with a waterproof lining that holds a reservoir of water at the bottom from which water is drawn upwards like a wick to the surface of the bed via natural soil osmosis or through the roots of plants in the bed. Basically it works like large Decor self-watering pot (http://www.decor.com.au/products/decorgarden/default.aspx).

Wicking beds are usually made with timber sides and a pond liner at the bottom to act as a water reservoir, but they can also be made out of plastic tubs or any other container that holds water and does not corrode when in contact with soil.

There are many different wicking bed designs involving a variety of construction materials however this website only looks at ones that I have made and tested myself.

wicking bed pros and cons

Below is a summary of wicking bed advantages and disadvantages to help you decide whether a wicking bed will meet your gardening needs.

Advantages

- Use between 40 and 50% less water than a conventional garden bed.
- Harder for weeds to establish as the soil on the surface is drier.
- Watering is semiautomatic, so it is possible to go away for two or three weeks at a time without your wicking bed drying out.
- Can be entirely watered by a low pressure water system, meaning it can be directly connected to a water tank without the use of a pressure pump.
• Ideal for gardens that have trees with invasive roots or are infested with Couch grass as it is very difficult for tree roots and Couch runners to penetrate into a wicking bed.

**Disadvantages**

• Much more expensive to build, approximately three to four times the cost of a conventional raised garden bed.
• The design is more complicated; it takes longer to build & requires a higher level of building skill.
• When the reservoir has water in it the underlying soil remains much damper, which can be a problem for some vegetables that prefer dryer conditions.
• Uses more materials to build than a conventional garden bed

**illustration comparing standard and wicking beds**

*Problems associated with a standard raised bed*  
Most water is on or near the surface, which maximises the evaporation rate and encourages weeds to germinate.

*Advantages of a wicking bed*  
Surface soil is drier as it is further away from the water source.

Wicking bed depths

The accepted wisdom regarding wicking beds is that water can only be effectively drawn up from the water reservoir at the bottom of a wicking bed to a height of around 30 cm. However this only applies to the osmotic process and does not take into account the ability of roots to extract water from much greater depths. Wicking beds can in fact be made to a variety of depths depending on the size and root structures of the plants you intend to grow in them. Below is a rough guide to the different depths for different sized plants.

Shallow wicking beds with a soil depth of around 15 to 20 centimetres draw the water to the surface of the bed providing ideal conditions for growing seedlings for transplanting.
Wicking beds with a depth of around 35 to 40 centimetres depth are suitable for growing vegetables.

Deep wicking beds with a soil depth of 50 centimetres or more are ideal for containing small trees and shrubs.

**seedlings : 15 to 20 cm**
Small wicking tubs with just 15 to 20 centimetres of soil above the water reservoir are ideal for growing seedlings for transplanting. At this depth the osmotic process draws moisture right to the surface of the soil, providing ideal conditions for seeds to sprout and young seedlings to grow.

There is however not enough space for the roots structure of most mature vegetables.

**vegetables : 35 to 40 cm**
Wicking beds or tubs with 35 to 40 centimetres of soil above the water reservoir provide a suitable height for growing vegetables. At this height the soil on the surface is fairly dry but allows all but the smallest seedlings to reach the moist area just below the surface with relative ease.

At this depth there is not only enough room for the vegetable roots to develop properly the drier soil on the surface reduces the number of weed seeds that germinate.

*If you are planting vegetable seeds into wicking beds of this depth you will have to water the seeds from above until the seedlings are big enough for their roots to reach the moister soil below.*

**small trees & shrubs : 50 plus cm**
Wicking beds or tubs with a soil depth of 50 or more centimetres are ideal for growing small trees or shrubs. At this depth the surface soil is very dry, inhibiting weed growth, while the greater volume of soil provides more room for roots to grow.

Wicking tubs of this depth are ideal for growing small trees in a vegetable patch as they prevent the roots from competing directly with nearby vegetables.

Wicking beds and tubs can also be used to contain plants that send out lots of suckers. I have used wicking tubs to contain raspberry canes.
how to make a small plastic tub wicking bed

Large wicking beds are built with timber sides and a pond liner at their base, however it is possible to make smaller wicking beds out of plastic containers. This section explains how to make a wicking bed using a plastic tub.

This was the first wicking bed I ever made. I have listed all materials I used with measurements.

- Plastic tub 35 cm H 60 cm wide & 75 cm long. *The size of the tub can of course be varied but I don’t recommend tubs shallower than 30 cm.*
- 20 mm threaded tank outlet with male and female threads.
- PVC pipe (note lengths will vary depending on the dimensions of your tub)
  - 1 - 90 mm x 35 cm
  - 1 - 65 mm x 35 cm
  - 1 - 50 mm x 60 cm
  - 1 - 50 mm x 30 cm
  - 1 - 50 mm elbow
  - 1 - 50 mm end
  - 1 - 50/90 mm adaptor
- 25 mm scoria stones
- Non woven weed matting.

To simplify matters 65 mm pipe could be used for all pipes and fittings but I had spare off-cuts handy so I used the multiple sizes that I had.

1. Drill hole at one end of the tub.

Drill a 20mm hole at one end of the tub so that the bottom of the hole is 7 cm above the bottom of the tub.
2. Install the 20 mm threaded tank outlet.
Install the 20mm threaded tank outlet, cutting the excess 20mm threaded pipe on the male end of the outlet and screwing it back into the female outlet so that both outlets are male (a section of threaded pipe sticking out)

This outlet pipe serves as an excess water overflow pipe to make sure the tub does not overfill and drown your plants.

A cheaper alternative is to silicon in a section of 20mm pipe, but this will not be as strong as using a 20mm threaded tank outlet.

3. Dig hole.
Dig a hole that is slightly larger than the tub with extra space at the outlet end.

Other options are to only half bury the tub or leave it on top of the ground.
In hot climates, it’s better to bury the tub fully

4. Level the tub
Using a spirit level get the top of the tub as level as possible. This is very important because if the tub is not level it may not drain properly and will create wetter and dryer soil spots.

5. Cut and drill the outlet observation pipes
Cut two pipes the height of the tub (or higher) and drill a 20mm hole 7 cm from one end of each pipe. For the pipe that is going on the inside of the tube cut some thin slots in the side of the pipe below the drilled hole. This is to allow water to flow in but keep the stones out.

Note that you do not need to have an outside protection/observation pipe if your wicking tub is going to be on top of the ground. Just cut one length of pipe for the inside if that is the case.

I used a grinder to cut the slots. You could drill holes instead of slots, but make sure the holes are fairly small. I suggest no more than 5 mm wide..

I used 90 mm PVC pipe for the one going on the outside of the tub and 65 mm PVC pipe for the one on the inside. I went for the 90 mm pipe on the outside so I could insert my hand to unblock the outlet pipe should if ever get blocked.
A number of different sized pipes could be used, just as long as you can insert the 20 mm threaded pipe into it.

6. **Install outlet protection/observation pipes**
   Install the outlet pipes by pushing them onto each end of the threaded 20mm tank outlet pipe. To make the threaded pipe fit into the 20 mm hole in each pipe you might need to make them slightly larger with a file. The 20 mm threaded pipe should fit snugly into the hole without any gape that dirt can get through.

   The outlet observation/protection pipes are there to prevent soil and stones from blocking the threaded tank outlet and allow any excess water to seep away.

7. **Cut and build the inlet pipe.**
   Cut two lengths of 50 mm PVC pipe, one long enough to run almost the length of the tub, the other the height of the tub.

   Cut slots or drill holes in the pipe that is to lie on the bottom of the tub. Alternatively you can use a length of 50 mm agricultural drainage pipe, which already has holes in it.

   Put a PVC cap at one end of the bottom pipe and connect it to the vertical pipe with a PVC elbow. Put a 50/90 mm adapter on top of the vertical pipe. This is where you add water to your wicking tub reservoir. There is no need to use PVC glue to connect the pipes and fittings as they do not need to be waterproof.

8. **Fill the bottom with stones**
   Fill with stones to the top of the threaded tank outlet pipe - about 9 centimetres high.

   I used 25 mm scoria stones but on later wicking beds I also used 20 mm bluestone stones. Both are fine, though the scoria is lighter and easier to shovel. It is also slightly cheaper.

9. **Cover stones with weed mat**
   Cover the stones with non woven weed mat. Cut a hole in the mat to push it over the upright pipes. Make sure the mat fits snugly around the pipe and edges of the tub because the weed mat is meant to prevent the soil from mixing with the stones. As weed mat is cheap I suggest you put two layers of weed mat down for extra protection and longer life.
10. **Fill with soil**
Fill to the top with a light friable soil. If your soil is very heavy then mix sand and organic matter with it to make it more friable. Add mulch on top.

If you have buried your tub in the ground as I did then fill in the hole around the tub and the outside PVC pipe

**concluding comments about building wicking beds in small plastic containers**

While this design worked quite effectively as a wicking bed there were three design flaws:

A. The 50/90 adapter was added as an afterthought as I found the 50 mm inlet pipe was too narrow for me to easily add water with my Dramm watering wand. If I had used 65 mm pipe for the inlet I would not have needed to use the adapter as 65 mm would have been large enough for the wand.

B. The main problem with this design was that I should not have placed the inlet and outlet pipes at opposite ends of the tub. You need to be able to see the overflow pipe as you are adding water to the inlet pipe so you know when the wicking bed reservoir is starting to overflow. Wicking beds that I built after this plastic tub bed all had the inlet and outlet pipes almost side by side.

C. Having a horizontal pipe channel under the bed of stones in such a small wicking bed is probably a bit of overkill and could be dispensed with. Later wicking barrel tubs that I made did not have this horizontal pipe, though admittedly they were a bit smaller in size than the plastic tub used for this bed.

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**how to build a wooden wicking bed**

This page offers step by step instructions on how to build a 3.6 metre long by 1.2 metre wide raised wooden wicking bed.

1. **Gather required materials**
The Raised Wooden Bed Materials List page lists the materials I used to make this bed. This list should only be seen as a rough guide. Feel free to substitute what you think would work better for you.

2. **Cut the end beams**
Cut the two 2.4 metre ironwood beams so you have 4 x 1.2 metre lengths. These will form the ends of the wicking bed.

3. **Level the Ground**
Level a section the ground where you are to build the raised bed.
I wanted the bed to be partially buried in the ground, so I dug out where the wicking bed was to go to a depth of 10 centimetres. However, most people just put their wicking beds on top of the ground.
4. Clamp and screw beams
The two ends are clamped and screwed together using 100 millimetre bugle batten screws as follows:
- On the levelled ground or trench, clamp together two 3.6 metre and two 1.2 metre beams to form a rectangle.
- Screw two 100 millimetre bugle batten screws into each end.
- Repeat the process to create another rectangle directly on top of the first one.

5. Assemble your planter box
Place the two 3.6 X 1.2 metre rectangles one on top of each other ready to be nailed together.

With a long 8 mm drill bit, drill pilot holes into the top rectangle and nail 250 millimetre landscape nails into these pilot holes to firmly secure the two rectangles together.

I used two landscape nails in each of the 3.6 metre lengths and a single nail in the 1.2 metre lengths.

6. Level soil and beams
- You should now have a rectangular wooden box 3.6 m long by 1.2 ms wide and 40 cm high.
- Using a spirit level, make sure the top beams are absolutely level then smooth out the soil in the bottom so it is as level as possible with the bottom beams.
- Remove any sticks or stones so that the soil is not only level but very smooth.

7. Drill the overflow outlet hole
- Halfway down one side of the bed drill a 20 millimetre hole so that the bottom of the hole is 7 cm above the bottom of the side of the bed.

8. Lay out the weed matting.
- Lay a layer of woven weed matting so it completely covers both the bottom and sides of the bed.
- Use a staple gun to tack the matting to the sides of the bed.

The picture shows woven weed matting being laid out first to prevent weeds and roots from puncturing the waterproof liner in the future.
9. Lay out pond liner
Lay the pond liner on top of the weed matting so that the liner is about 10 centimetres high on the sides of the walls. The weed matting goes all the way to the top.

Using a staple gun staple the pond liner to the walls to hold the liner in place, but make sure you only staple the very top of the pond liner at points above the intended high water mark.

10. Insert 20 mm threaded tank outlet.
   - Cut a hole through the pond liner and woven weed matting where it covers the overflow outlet hole you have drilled into the timber and insert the 20 mm threaded tank outlet.
   - Screw in the threaded covers so the pond liner and weed matting is clamped firmly to the wood.

11. Lay another layer of weed matting
   - Place another layer of woven weed matting over the pond liner and the first layer of weed matting. Again use a staple gun to tack the weed matting in place.
   - Where the weed matting covers the threaded tank outlet cut a small hole the matting to let the outlet poke through.

12. Cut hole and insert PVC outlet/observation pipe
   - Take a 400 mm section of 90 mm PVC pipe and cut a 20 mm hole near one end so that the edge of the hole is 7 cm from the end of the pipe.
   - Cut slots or drill holes at the 20 mm hole end of the pipe to allow water to flow into the pipe.
   - Once you have done this hold the pipe upright with the 20 mm hole at the bottom and push the 20 mm threaded tank outlet through the 20 mm hole so that the PVC pipe stands upright.

Details of how to drill the hole into the pipe and cut the slots can be found in the Cut And Drill Outlet Observation Pipes section of How To Build A Plastic Tub Wicking Bed.

13. Build the inlet pipe with elbow and t piece
   - Take a 40 cm section of 100 mm PVC pipe and connect to a 100 mm T piece.
   - Where the T piece sticks out at right angles put in a 100 to 50 mm reducer.
   - Connect a 50 mm T Piece to the end of the 50 mm reducer so that the two ends of the 50 mm T piece stick out horizontally.
   - Place the completed section next to the PVC outlet/observation pipe

I used 100 mm PVC pipe with a 100 mm T piece to allow enough space for a low pressure float valve to be inserted into it. If you are not using a low pressure float valve than I suggest you use 90 or 75 mm PVC pipe with an elbow instead of a T piece.

You could even use all 50 mm pipe and do away with having to use a reducer, but this would mean you would have a very small inlet for watering.
14. **Lay out Drainage pipe and cover with stones**

- Attach a length of 50 mm agricultural drainage pipe to one end of the 50 mm PVC T piece. Then snake it around the bottom of the wicking bed and attach the other end to other side of the 50 mm T piece.
- Spread stones evenly across the bottom of the bed to a height of around 7 cm.

I used bricks both to hold the agricultural pipe in place and to measure the height of the stones. As a brick is 7 cm high I filled the bottom with stones to the height of the bricks then simply removed the bricks and filled in the holes left by the bricks.

15. **Cover with weed matting and fill with soil.**

- Cover the top of the stones with two layers of non woven weed matting. Where the PVC pipes stick up cut holes in the matting and push it over the tops of the pipes.
• Fill with friable soil until nearly full.

The weed matting is to stop the soil from mixing with the stones as water has to move freely through. So it is important to tuck the matting right up against the walls of the bed. You could probably get away with one layer of weed matting but as it is relatively cheap I thought it was worth using an extra layer just to make sure.

For the best results the soil needs to be friable sandy soil. Heavy clay soils will not do. If your soil is heavy then mix it with sand and mulch to make it more friable.

**Stones covered with two layers of non woven weed matting.**

16. **Tack sides and top up with soil**

• Fold over the woven weed matting and tack it to the sides using 13 mm button head needlepoint screws. If the end of the weed matting is too long then cut some of it off before folding it.
• Top up with a bit more soil

I didn't tack the weed matting until the very last as the adding of the soil created a bit of settling and movement of the matting.

You now have a finished wicking bed.

**Woven weed matting folded over and secured with screws.**
CONCLUSION

This design has proven to be very successful.

The only thing I would definitely have done differently is use an extra four landscape nails to nail the bottom and top sections of the walls together as there was some minor lifting at the corners due to the aging of the timber. Using some extra nails would probably have stopped this.

It also might have been wise to put down a few centimetres of fine sand before laying out the pond liner, which is standard practice when building a conventional pond.